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24. OVERWINTERING POPULATION OF *DANAUS* (*SALATHURA*) *GENUTIA* IN TIGER VALLEY IN SANJAY GANDHI NATIONAL PARK, MUMBAI, MAHARASHTRA

(With one text-figure)

Many species of butterflies migrate from cold temperate regions of the northern latitude to warmer regions during fall, and move north during spring (Williams 1930). The Monarch butterfly (*Danaus plexippus*) of North America is one of the best studied for its migratory behavior (Urquhart 1976, 1978; Urquhart and Urquhart 1979; Brower 1995). Mark, Release and Recapture (MRR) studies showed that the migrating Monarchs reached Sierra Madre Occidentale mountains in Northern Mexico where they hibernate in millions. At the onset of spring they move northwards and lay eggs on milkweed plants in the southern USA. The next generation from these eggs moves to breed further north (Brower 1995).

Most of the butterflies from the northeastern North America overwinter in Sierra Madre Occidentale and Alpha in Mexico. But the populations west of the Rockies congregate in huge numbers on the West Coast in California, in places such as the Monterey Peninsula. Urquhart (1965) defined two types of colonies in California, a transient roosting colony of short duration and a long-term roosting colony. Individuals of short term roosting colonies leave the roosting site under suitable conditions to take nourishment, but do not come back to the same site, while long-term roosting colonies stay in the roosting sites for a long period of time. Unlike some hibernating organisms that do not move, overwintering butterflies are free flying individuals in reproductive diapause, although

some females may be gravid (Ackery and Vane-Wright 1984). Some species congregate at overnight roosting sites, particularly in cold and windy weather. This is defined as nocturnal, communal or gregarious roosting behaviour (Ackery and Vane-Wright 1984). Such butterflies leave the site in the morning and may not return to the same spot the next day. Migration of the Danainae butterflies, especially *Tirumala*, *Euploea*, *Danaus* and *Parantica*, has also been recorded in India and elsewhere in south and southeast Asia (Williams 1930; Chaturvedi 1998 and references therein). Other observers at the beginning of the 20th century have described gregarious or nocturnal roosting behaviour for *Tirumala hamata* in Queensland, Australia (McNeill 1937), *Tirumala petivariana* in E. Africa (Poulton 1934), and *Danaus genutia* in Hongkong (Kershaw 1905-1907). Although migration of danaids has been described in India, it was presumed that the migratory population dispersed with the local population. Also, there was no evidence of overwintering populations.

On March 3, 1992, in the company of Ulhas Paralkar, Amar Mehta, and others in the Sanjay Gandhi National Park, near Tulsi dam, in Mumbai, Maharashtra, I came upon a huge congregation of Common Tiger *Danaus* (*Salathura*) *genutia* butterflies, near the water filtration system outlet between the pipelines. As we approached, the butterflies resting on the ferns and bamboo clumps were disturbed and flew all around us in a thick cloud. This location will now

be referred to as Tiger Valley. Observations within about 300 m along the stream suggested that males were more common than females. We had no net to facilitate marking, but took photographs and noted whether they were moving in any particular direction. As it was late on a hot afternoon, most of the butterflies were resting, and when disturbed they would fly around for a very short time before settling back on the leaves, twigs or elsewhere. Bamboo clumps accommodated larger numbers and as many as 32 were seen at one time on a bamboo shaft about 1 cm thick and 1 m tall. I estimated more than 30,000 butterflies at that site. We decided to return to the Valley the subsequent week, to determine if the butterflies were still there and if so to carry out Mark, Release and Recapture (MRR) studies.

During the next few weeks, Ulhas Paralkar, Amar Mehta and I returned on weekends to Tiger Valley between March and July 1991, to conduct MRR studies. We made 11 trips during this study period. The markings were carried out around 1100 hrs to 1300 hrs. We painted the butterflies with either different coloured paints or nail polish (white or blue oil paints and pink nail polish), preferably on both the hind-wings, as these can

be seen easily even when the butterfly is resting. On each occasion we marked them with a different colour, so that the area of marking and colour code was unique for a given date. When a marked butterfly was recovered, we marked it again with the day's code to determine the recovery number. During initial releases, we noted the direction in which they flew off. Later we discontinued this recording, as there was no particular directional flight. The condition of each butterfly was also noted.

TABLE I
THE RESULTS OF MRR STUDIES OF *D. GENUTIA* IN
SANJAY GANDHI NATIONAL PARK, MUMBAI

Date of marking	Captured		Recoveries
	Males	Females	
8.iii.1992	0	0	-
15.iii.1992	76	29	0
5.iv.1992	32	52	0
25.iv.1992	49	47	0
3.v.1992	27	42	5
10.v.1992	59	77	3
24.v.1992	58	48	7
31.v.1992	22	40	3
7.vi.1992	29	44	9
14.vi.1992	21	74	8
26.vii.1992	0	0	0
	373	453	

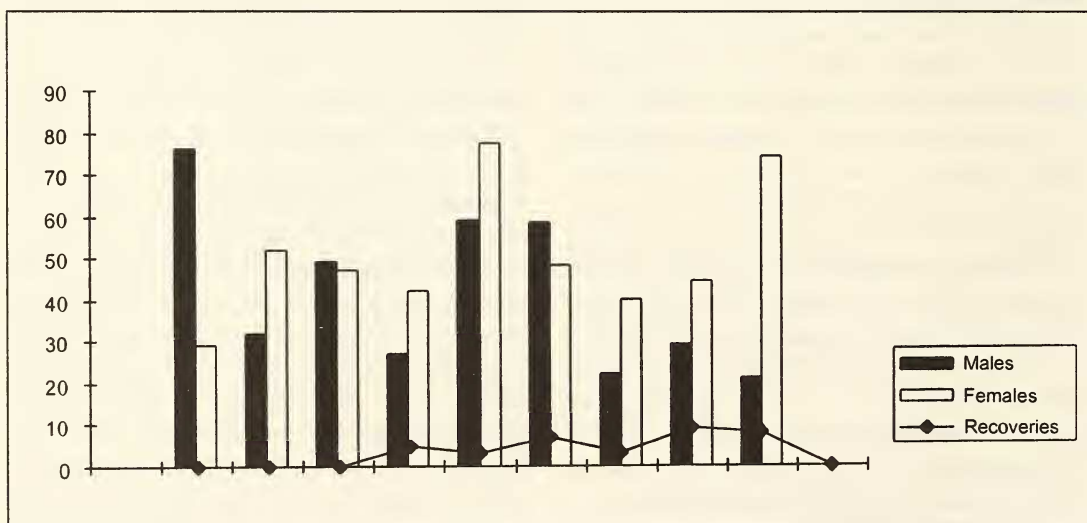


Fig. 1: Results of MRR studies of *Danaus genutia* in Tiger Valley, Sanjay Gandhi National Park

A total of 826 butterflies were marked, of which 373 were males and 453 females. 35 butterflies were recaptured, of which two were recaptured twice (Table 1, Fig. 1). During the first two weeks, none were recaptured. Most of the recoveries were after 7 to 21 days after the day of marking. Seven butterflies were recovered after 35 days. One individual was recorded after 49 days and again 63 days later (Table 2). We captured significantly higher number of females than the males except on the first day when we captured more males (Wilcoxon's paired rank test $t = 2.547, p = < 0.01$). Initially the butterflies were in fair condition, but by May and June the females in particular seemed worn out. We also observed that most of the males captured during the last two weeks of June looked newly emerged or fresh. Fifteen marked butterflies were also observed in the area, but could not be caught as they were in an inaccessible area. On our last visit on July 26, 1992, no butterflies remained in Tiger Valley.

We arrived at the study location in the afternoons, as we had to walk at least 7 km to reach it. At this time, the butterflies were mainly resting. We also observed courtship display and several mating pairs. A few butterflies were observed feeding on moist earth, particularly after the burning of the undergrowth in June. Only one tree *Wrightia tinctoria* was flowering during the first week of April. Several Danainae were seen feeding on its blossoms. About 500 m away,

near the overflow of the dam there were patches of *Heliotropium indicum* where a few Common Tigers were also seen feeding, but no marked individuals were observed in these patches.

To determine whether the butterflies left this location at any other time of the day, and if so, when and in which direction, one evening, we reached Tiger Valley at about 1730 hrs, caught a few specimens, and kept them in a bag, to release them in the morning. The next day, we reached the valley at about sunrise and released the butterflies. We stationed ourselves at various places to record the direction of flight, and to see if the roosting butterflies left the site in the morning. The released butterflies flew in a somewhat southerly direction for less than a few hundred metres and remained on the top of the canopy until the sunlight reached the Valley. As the sun reached the canopy, they started fluttering and moving slowly towards the upper end of the canopy where they basked, and after about an hour, when the temperature rose, they slowly started moving down. By about 1030 hrs they all seemed to be settled and resting. One of their major activities was basking. The sunlight reached the Valley in spots and its intensity varied in the canopy. The butterflies generally preferred shade. There was a dense growth of fern in the Valley in the flowing water, and many butterflies were seen sitting on them. The major plants in the area were identified as *Macaranga peltata*, *Ficus* sp. *Adina cordifolia*, *Caryota urens*, *Putranjiva roxburghii*, and *Mangifera indica*.

The high recovery of marked butterflies (4-5%) suggests that this population was quite stable. We did not recover any butterflies in the first three visits since we started marking (Table 1). This could be explained by the low probability of recapture when the numbers were high or that the population was not stable at that time (moving out of the area and being replaced by a fresh group of butterflies). But, as we did not see any movement in the congregation site, the latter

TABLE 2
FREQUENCY OF RECOVERY OF *DANAUS GENUTIA*

Recovered after days of marking	Number
0	1
7	9
14	9
21	3
28	2
35	7
42	1
49	2
56	0
63	1

explanation seems unlikely. Also, the recovery seemed to increase later. Although there were butterflies at various heights, up to about 15 m, our captures were mostly from butterflies roosting on the ferns, and easily reachable. The results suggest that the butterflies remained at or near the site where they were captured initially. Thus, it seems likely that this population was an overwintering population, which at the onset of monsoon or a suitable season dispersed to breed. Host plants such as *Ceropegia* sp., *Marsdenia* spp. (I did not record any larvae on these plants) were very few in the Park and could not support the whole population. This suggests that this large population could not have bred in the Park and would have to disperse outside the Park to breed. In Mumbai, although Chaturvedi (1979, 1998) and I have observed migration of other danaids in fairly large numbers, such numbers of *D. genutia* have not been seen. There is a possibility that the butterflies arrived in smaller numbers and assembled here. During October and November we generally observe movements of butterflies from north to south, and northward migration is observed at the onset of monsoon from July onwards (Chaturvedi 1998 and MH pers. obs.). No migratory movements are observed during March to June. So why did the butterflies select this place? Is it a traditional hibernating spot unknown so far? A worker at the filtration plant, when questioned, said that he had not seen large congregations of these butterflies earlier. Amar Mehta and Ulhas Paralkar visited the site again in 1993, but did not find the butterflies. They noticed that the undergrowth had been cleared. It seems that the butterflies chose this site as it was cool and moist even in summer, with a continuous supply of water from the filtration plant to provide ideal conditions for overwintering. I have seen relatively large numbers of danaids, especially *Euploea core* and *E. klugii* in the region but no congregation.

There is no earlier record of overwintering populations in the Park or elsewhere in the country. In fact, no such phenomenon has been recorded for any other danaid in the Eastern Hemisphere. Climatic conditions in the Eastern Hemisphere are very different from those in the Western Hemisphere. The Common Tiger butterflies are found throughout the Indian subcontinent from southern Kashmir eastward to China and south. Thus, it seems possible that the northern population would migrate south to escape the cold and dry weather of north India. If these butterflies are from the population in north India, we may consider them overwintering butterflies during dry months. The butterflies caught in the beginning were already a few days old and had lived for at least four months. Therefore, we suggest that these butterflies dispersed to breed when the conditions improved in monsoon. Unfortunately, we did not conduct any studies to find out the reproductive condition of these butterflies in their overwintering sites, but have evidence that they mated when they were at the site. Further study to answer these questions is impossible, as the site has already been destroyed and it is possible that the butterflies have found another similar site.

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25. ON *HESTIASULA BRUNNERIANA* SAUSSURE (INSECTA: MANTODEA) FROM PUNE, MAHARASHATRA

(With three text-figures)

On August 19, 1998, we first collected a colourful male specimen of a preying mantis on the campus of Pune University. Additional specimens, two males and three females, were collected in Pune during 1998-2000. All the mantids were collected live and maintained in the laboratory to observe food, feeding and general behaviour. Only four specimens have been preserved.

The important diagnostic characters of this mantis were as follows: External spines of the fore tibiae numerous, closely set (Family Hymenopodidae). Frontal sclerites without wing-like keels, eyes within circumference of head (Subfamily Acromantinae). Middle and hind femora without any significant lobe, disc of frontal sclerite smooth, superior border of fore

femora strongly arched and foliaceous (hence the genus *Hestiasula*). The species *H. brunneriana* was confirmed by the characteristic pattern of bold black blotches on the inner face of fore femora (3 blotches on the superior margin and one black spot near the spine in the middle of the fore femur) (Mukherjee *et al.* 1995).

Major taxonomic characters of this species are already given by Mukherjee *et al.* (1995). However, variations that we found in the two female specimens collected at Dapodi (27.iii.2000 and 2.iv.2000 specimens) are:

1) The costal area of the forewing was brownish opaque in two females and brownish-green in one male. Even in the live specimen, the brownish colour was evident in these two females as against the distinct green in others